open end of the conveyor trough **12** into the weighing mechanism **16**.

In the illustrated embodiment, the chute **10** has a bottom wall **50** and short side walls **52** and **54** wherein the width between sidewalls **52** and **54** is slightly greater than the width of the conveyor trough **12** between its side walls **42** and **44**. It not necessary for the chute **10** to have this width through its length; this width is only necessary at the upper end **20** and below the opening **24** so that the entire width of the snack chip stream is subjected to separation of the crumbs from the unbroken chips.

The upper end **20** is curved with a convex upper surface which is tangential to a horizontal plane sharing the same plane or parallel to and below the horizontal bottom wall **40** of the conveyor trough **12**. The curved or rounded surface prevents damage or breakage that could be caused by a sharp edge. Preferably the end **20** has a radius of curvature in the range from one-fourth to one inch (0.63 to 2.5 centimeters). Also the upper end **20** is disposed in front of the open end **22** of the conveyor trough **12** so that the larger or unbroken chips in the chip product stream are pushed over the curved end **20** by trailing chips driven by the vibratory motion of the conveyor trough **12**. Preferably the convex upper surface of the curved end **20** is tangential to the horizontal plane defined by the upper surface of the bottom wall **40** of the conveyor trough **12**.

The opening **24** defined by the spacing of the curved end **20** of the chute **10** in front of the discharge end **22** of the trough **12** is selected to allow smaller particles, such as fines and crumbs or small broken pieces of chips to fall through the opening onto the chute bottom **50** below the trough **12**. For triangular, rectangular, round or oval tortilla chips, corn chips and potato chips with diameters from 1 to 5 inches (2.5 to 12.7 centimeters), an opening of from about three-fourths to two inches (1.8 to 5.1 centimeters) as measured at **60** from the trough end **22** to the horizontal tangent point on the curved end **20** effectively separates most of the fines and small pieces of broken chips from the unbroken and larger chip pieces. Some smaller chip pieces (less than one inch or 2.5 cm) and fines are carried on top of larger pieces over the opening **24**, but this quantity is small (equal to or less than 10% by weight of the smaller chip pieces and fines in the product stream in the trough **12** when the chute is optimally positioned) compared to the quantity of smaller chip pieces that are separated from the product stream and discharged to the crumb receptacle.

The vibrations of the trough end **22** on one side of this opening combined with a stationary or out-of-phase vibrating upper chute end **20** on the other side of this opening insure that the opening is not clogged by the irregularly shaped pieces. Pieces which hang up in the opening **24** will be either dislodged or crushed so as to fall through the opening **24** or driven over the curved end **20**.

The chute **10** as illustrated in FIG. **1** has an upper portion **70** which is inclined at about 30° from a horizontal plane and a lower portion **72** which is inclined at about 60° from a horizontal plane. The particular shape of the illustrated chute **10** is dictated by the need to carry the crumbs from the discharge end **22** of conveyor trough **12** over the weighing mechanism of the bagger **16** and into the conveniently placed crumb receptacle **36**. Generally any chute **10** of 30° inclination or more is suitable for carrying the crumbs away under the force of gravity. For angles of inclination which are substantially less than 30° the chute may require some assistance in addition to gravity (such a vibrations, augers, etc.) to carry the crumbs from the discharge station of the vibratory conveyor. The optimal shape of the chute will vary depending on the physical restraints surrounding its installation. In the illustrated embodiment, the chute is a single unit with two differently inclined sections extending in the same general direction. In alternative embodiments, the chute can be a simple straight or curved incline or two or more separate straight and/or curved inclines mounted at angles and extending in directions that best facilitate the removal of crumbs and particulates.

The disclosed chute **10** is relatively inexpensive and easy to install on existing or conventional product handling and processing equipment. It further provides surprisingly effective separation of smaller particles from larger particles in a product stream.

EXAMPLE 1

In an initial test of the crumb removal system, a system similar to FIG. **1** was constructed with the spacing **60** set at about 1 inch (2.5 centimeters) and with the convex upper surface of the curved end **20** tangential to the upper surface of the bottom wall **40** of the conveyor trough **12** which vibrated at a frequency of about 60 cycles per second. The curved end had a radius of curvature of about one-half inch (1.2 centimeters). Triangular tortilla chips, about 2½ to 3 inches (6.3 to 7.6 centimeters) in diameter when unbroken, were fed by the conveyor trough **12** over the curved end **20** of the chute **10**. Approximately 2.5% of the total weight of a batch of triangular tortilla chips constituting about 90% of the fines and broken pieces of less than 1 inch (2.5 centimeters) in diameter were removed from the batch by passing down the chute **10**.

EXAMPLE 2

In prototype crumb removal systems installed in production lines for the triangular tortilla chips, the chutes were set with the convex upper surfaces of the curved ends being about 0.25 inches (0.6 centimeters) below the horizontal planes of the conveyor troughs and with a spacing **60** of about 1 inch (2.5 centimeters). About 1% of the total weight of the product on the conveyor troughs **12** was removed by the chutes **10**. This constituted about 70% by weight of the fines and broken pieces less than 1 inch (2.5 centimeters) in diameter in the product stream on the conveyor troughs **12**. The chute ends **20** were spaced below the horizontal planes of the troughs **12** to overcome buildup of fines on the chutes below the opening **24**; this reduces the percentage of fines and broken pieces being removed but still results in an improved product.

Since many modifications, variations and changes in detail may be made in the disclosed embodiment without departing from the scope and spirit of the invention, it is intended that all matter described above and shown in the accompanying drawings be interpreted as only illustrative of the illustrated embodiment and not limiting on the invention as defined in the following claims.

What is claimed is:

1. An apparatus for separating substantially intact products from smaller, partial pieces of the intact products, comprising:

a conveyor means for transporting a product stream in a downstream direction, the product stream